

MOBILE OBJECT POSITION DETECTING APPARATUS AND METHOD

Background of the Invention

5 1. Field of the Invention

The present invention relates to a mobile object position detecting apparatus and method, and more particular to an apparatus and a method for warning of inability to detect a position due to faulty equipment.

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2. Description of the Related Arts

Conventionally, there has been an emergency information device for detecting the current position of a vehicle and detecting the current positions of a navigation system for providing a guide to the destination so that the information about the occurrence of an accident, etc. and the position of the car can be transmitted in an emergency. In detecting the current position of the vehicle, a GPS device (Global Positioning System) has been widely used by a GPS receiver receiving and processing radio waves including the position information from a GPS satellite received by a GPS antenna of the GPS device, thereby detecting the current position.

However, the GPS antenna is normally provided in a position not easily checked by common users, and a ski carrier, a wiper, a metal film applied to the window of a vehicle, etc. in the reception area of the GPS antenna can disable radio waves to be received from the GPS satellite. Additionally, faulty connections to the GPS antenna and the GPS receiver or other faults can interrupt radio waves. In these cases, the current position a vehicle cannot be correctly measured. The following Patent Document 1 relates to an

emergency information center apparatus, and designates the current vehicle location including the travel range, the angular range, and the initial error of the vehicle from the travel locus according to the position information about the final measurement position
5 when the on-board device using the position data only about the GPS transmits emergency information and the GPS system cannot measure the position.

[Patent Document 1]

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10 However, in the vehicle position designating method disclosed by the above-mentioned Patent Document 1, the current position cannot be correctly designated or the measuring process cannot be performed when abnormal reception of radio waves continues for a long time due to faulty equipment such as the interruption of the operation
15 of the GPS antenna by any obstacles, a faulty connection or other faults of an antenna, etc.

Therefore, it is necessary to detect the presence/absence of receiving radio waves including position information, and warn a person in the vehicle of abnormal reception due to faulty equipment.

20 However, when a vehicle is traveling through a tunnel, in a mountainous area, among large buildings, etc., the radio waves from the GPS satellite often cannot be received due to geographic conditions which interrupt the GPS satellite and the GPS antenna. Therefore, if a warning is issued to a person in the vehicle only
25 by detecting the presence/absence of receiving radio waves from the GPS satellite, then geographic conditions which may temporarily interrupt the radio waves can be reported as an incapability warning. This frequently bothers the person in the vehicle.

Therefore, the present invention aims to provide the mobile object position detecting apparatus for warning of abnormal reception due to faulty equipment without a warning for temporary incapable reception of position information due to geographic
5 conditions.

3. Summary of the Invention

The mobile object position detecting apparatus according to the present invention detects the position of a mobile object
10 according to position information transmitted from an external position information transmission apparatus, and includes:
reception status detection means for detecting the presence/absence of receiving position information; travel distance obtaining means for obtaining the travel distance of a mobile object receiving no
15 position information; determination means for determining the abnormal reception due to faulty equipment when the travel distance exceeds a predetermined distance; and warning means for warning of the abnormal reception when the determination means determine the abnormal reception.

20 The mobile object position detecting apparatus according to the present invention detects the position of a mobile object according to position information transmitted from an external position information transmission apparatus, and includes:
reception status detection means for detecting the presence/absence
25 of receiving position information; traveling time obtaining means for obtaining the traveling time of a mobile object receiving no position information; determination means for determining the abnormal reception due to faulty equipment when the traveling time exceeds a predetermined time; and warning means for warning of the

abnormal reception when the determination means determine the abnormal reception.

The mobile object position detecting apparatus further includes mobile object speed detection means for detecting the speed of a mobile object, wherein the traveling time of the mobile object is
5 a real traveling time in which a speed of the mobile object is detected as greater than 0km/h.

Additionally, in the mobile object detecting apparatus
10 according to the present invention, a mobile object is a vehicle, and travel distance obtaining means obtain the travel distance based on the turn of wheels.

Furthermore, in the position detecting apparatus according to the present invention, determination means releases the
15 determination of abnormality when position information is first received after determining abnormal reception.

The mobile object position detecting method according to the present invention detects the position of a mobile object according to position information transmitted from an external position
20 information transmission apparatus, and includes: a reception status detecting step of detecting the presence/absence of receiving position information; a travel distance obtaining step of obtaining the travel distance of a mobile object receiving no position information; a determining step of determining the abnormal
25 reception due to faulty equipment when the travel distance exceeds a predetermined distance; and a warning step of warning of the abnormal reception when the determining step determines the abnormal reception.

The mobile object position detecting method according to the present invention detects the position of a mobile object according to position information transmitted from an external position information transmission apparatus, and includes: a reception status
5 detecting step of detecting the presence/absence of receiving position information; a traveling time obtaining step of obtaining the traveling time of a mobile object receiving no position information; a determining step of determining the abnormal reception due to faulty equipment when the traveling time exceeds
10 a predetermined time; and a warning step of warning of the abnormal reception when the determining step determines the abnormal reception.

The mobile object position detecting method further includes a mobile object speed detecting step of detecting the speed of a
15 mobile object, wherein the traveling time of the mobile object is a real traveling time in which a speed of the mobile object is detected as greater than 0km/h.

Additionally, in the position detecting method according to
20 the present invention, a mobile object is a vehicle, and a travel distance obtaining step obtains the travel distance based on the turn of wheels.

Furthermore, in the position detecting method according to the present invention, a determining step releases a determination of
25 abnormality when position information is first received after determining abnormal reception.

The mobile object position detecting apparatus according to the present invention detects the position of a mobile object according to position information transmitted from an external

position information transmission apparatus, and includes: a position detector for receiving position information and detecting the position of a mobile object; a travel distance detector for detecting the information about the travel distance of the mobile object; a controller for computing the travel distance of the mobile object while the position detector is not receiving the position information based on the output of the position detector and the travel distance detector, and determining abnormal reception due to faulty equipment when the travel distance exceeds a predetermined distance; and a warning device for warning of the abnormal reception when the controller determines the abnormal reception.

The mobile object position detecting apparatus according to the present invention detects the position of a mobile object according to position information transmitted from an external position information transmission apparatus, and includes: a position detector for receiving position information and detecting the position of a mobile object; a timer for detecting a duration in which the position detector is not receiving the position information; a controller for defining the duration detected by the timer as a traveling time of the mobile object, and determining abnormal reception due to faulty equipment when the traveling time exceeds a predetermined time; and a warning device for warning of the abnormal reception when the controller determines the abnormal reception.

The mobile object position detecting apparatus according to the present invention further includes a mobile object speed detector for detecting the speed of a mobile object, wherein the timer detects the real traveling time of the mobile object while the mobile object speed detector is detecting the speed of the mobile object.

4. Brief Description of the Drawings

FIG. 1 shows the overall configuration of the emergency information apparatus of a vehicle according to the first embodiment of the present invention;

FIG. 2 shows the appearance of the emergency information apparatus according to the first embodiment of the present invention;

FIG. 3 is a flowchart of the operation of the emergency information apparatus according to the first embodiment;

FIG. 4 shows the overall configuration of the emergency information apparatus of a vehicle according to the second embodiment of the present invention;

FIG. 5 is a flowchart of the operation of the emergency information apparatus according to the second embodiment of the present invention;

FIG. 6 shows the overall configuration of the emergency information apparatus of a vehicle according to the third embodiment of the present invention; and

FIG. 7 is a flowchart of the operation of the emergency information apparatus according to the third embodiment of the present invention.

5. Description of the Preferred Embodiments

The preferred embodiments of the present invention (hereinafter referred to as embodiment) are described below with reference to the attached drawings. As an embodiment of the mobile object position detecting apparatus of the present invention, an emergency information apparatus of a vehicle having the function of detecting the position of a vehicle is described below.

Embodiment 1

FIG. 1 shows the overall configuration of an emergency information apparatus 1 of a vehicle according to the present embodiment. The emergency information apparatus 1 of a vehicle
5 detects the current position of the vehicle according to the position information transmitted from an external position information transmission apparatus, and informs a call center and an information destination (not shown in the attached drawings) such as a police station, a fire department, etc. in an emergency such as an accident
10 or a fault of a vehicle, acute illness of a person in the vehicle, etc. of the position information about the vehicle and the nature of the emergency. In the present embodiment, the emergency information apparatus 1 warns of abnormal reception due to faulty equipment for position information.

15 The emergency information apparatus 1 is connected to each element described below, and comprises a control unit 10 for controlling the overall operation in various data processing operations. The control unit 10 normally comprises a CPU, ROM, RAM, etc., and processes digital data. In the present embodiment, the
20 control unit 10 comprises, as described later, reception status detection means for detecting the presence/absence of receiving position information, travel distance obtaining means for obtaining the travel distance of a mobile object receiving no position information, and determination means for determining abnormal
25 reception due to faulty equipment when a travel distance exceeds a predetermined distance.

The emergency information apparatus 1 comprises a position detection unit for detecting the position of a mobile object according to the position information transmitted from an external position

information transmission apparatus. According to the present embodiment, the position detection unit is formed by a GPS device, and a GPS antenna 12 is connected to the control unit 10 through a GPS receiver 14. A GPS satellite as an external position
5 information transmission apparatus transmits radio waves which are received by the GPS antenna 12, and the GPS receiver 14 detects the current position of the vehicle. That is, the radio waves from the GPS satellite include transmission time information from the GPS satellite, and the GPS receiver 14 detects the current position
10 of the vehicle according to the transmission time information about the radio waves and the reception time information from the GPS receiver 14. Therefore, in the specifications, the position information is a concept that also includes the information about the time in which the position of a mobile object can be computed,
15 etc. Additionally, by receiving error information contained in the radio waves transmitted from the GPS satellite in the FM multiplex broadcast, the D-GPS device (differential GPS) for detecting a position with high precision can also be used as a position detection unit. In this case, the error information is included in the position
20 information. The radio waves from the GPS satellite received by the GPS antenna 12 are processed by the GPS receiver 14, and 2D position data of latitude and longitude data, or 3D position data of latitude, longitude, and height are detected. The current position of the vehicle detected by the GPS receiver 14 is supplied
25 to the control unit 10. It is also possible to supply the position information received by the GPS receiver 14 to the control unit 10, and the control unit 10 can detect the current position of a vehicle.

The control unit 10 is connected to an emergency sensor input unit 16 to which an airbag-open signal, a crash signal, and other emergency signals warning of abnormal conditions of a vehicle are input. That is, the emergency sensor input unit 16 receives a signal
5 from an emergency sensor provided for the vehicle, converts it into predetermined digital data, and supplies the result to the control unit 10.

In the present embodiment, the control unit 10 is connected to a vehicle speed pulse input unit 18 for supplying a vehicle speed
10 pulse signal generated with rotation of the wheels of the vehicle to the control unit 10. Thus, the control unit 10 can compute the travel distance of the vehicle, and can determine the abnormal reception of position information due to faulty equipment based on the presence/absence of receiving position information and the
15 travel distance of the vehicle.

The storage unit 20 stores the phone numbers of information destinations in advance such as predetermined rescue missions, for example, a police station, a fire department, a service center, etc., and the ID of the vehicle to which it belongs. The storage
20 unit 20 can also store the position data of the vehicle, to which it belongs, detected by the GPS receiver 14. Thus, for example, when an accident occurs, etc. and if position information has not been received, the position information immediately before the current point or about the past can be read from the storage unit
25 20 and transmitted to the information destination. The storage unit 20 can be any of semiconductor memory, a hard disk, CD-ROM, etc. The data of the storage unit 20 can be provided for the control unit 10 at a request of the control unit 10.

The emergency information apparatus 1 comprises a radio communications unit 22 as a communications device. The radio communications unit 22 can be a terminal of various types of mobile communications, for example, a mobile phone.

5 The radio communications unit 22 is connected to the control unit 10, and the control unit 10 controls the communications of data. For display, when the control unit 10 receives an emergency signal from the emergency sensor input unit 16, it controls the radio communications unit 22, and an emergency signal, the current
10 position of a vehicle, etc. are transmitted to an information destination.

 The control unit 10 is connected to a microphone 26 and a speaker 28 through a hands-free system 24. The microphone 26 is used in inputting various information by a user, and can receive voice input.
15 The speaker 28 is used in outputting various voice data, and outputs voice information from an information destination. For example, when an information destination issues an inquiry after emergency information is transmitted to the information destination, the user can communicate with the information destination in a handsfree
20 state using the microphone 26 and the speaker 28.

 The control unit 10 is connected to an operation switch unit 30 as input means for a user. The control unit 10 is also connected to an indicator 32 indicating the operation status of the emergency information apparatus 1.

25 FIG. 2 shows the appearance of the emergency information apparatus 1 according to the present embodiment. For example, the operation switch unit 30 and the indicator 32 are provided near the driver seat for easy access and drive by a driver.

The operation switch unit 30 includes an emergency switch, a volume control switch, etc. for control of various input. When an accident, an acute illness, a fault of a vehicle, etc. occurs, a person in the vehicle operates an emergency switch to supply an emergency signal from the emergency switch to the control unit 10, and the control unit 10 controls the radio communications unit 22 and notifies the destination information for the emergency.

In the present embodiment, the indicator 32 warns of abnormal reception due to faulty equipment for position information. As shown in FIG. 2, the indicator 32 comprises indicators of three colors, that is, a green indicator 32a, an orange indicator 32b, and a red indicator 32c. The green indicator 32a is turned on when the apparatus is normally operated, when an emergency service contract is signed, etc. The orange indicator 32b is turned on when abnormal reception occurs due to faulty equipment. The red indicator 32c is turned on when the apparatus is in a faulty condition. Faulty conditions refer to the case in which the GPS device itself is in a normal condition, but any obstacle such as a ski carrier, a wiper, a metal film applied to the window of a vehicle, etc. interrupts radio waves, the GPS antenna 12 has a faulty connection, or the GPS antenna 12 or the GPS receiver 14 is in a faulty condition. In the present embodiment, the faults of the GPS antenna 12 and the GPS receiver 14 are detected by the fault detection circuit provided for the GPS device. Therefore, when the fault detection circuit detects a fault, the red indicator 32c is turned on. When there is no fault detection circuit, the fault of the apparatus itself can also be warned of by the orange indicator 32b. Thus, since the abnormal reception due to faulty equipment turns on the orange indicator 32b, the person in the vehicle can recognize the

abnormal reception of position information due to faulty equipment. As a result, the person in the vehicle can check the facilities, repair them, and allow the position information to be correctly received. The indicator 32 can warn of an emergency by lighting or blinking. As means for warning of abnormal reception due to faulty equipment, the abnormal reception can be indicated not by an indicator, but by a display, voice output, etc.

Described below is the determination of abnormal reception due to faulty equipment mainly from the control unit 10. As described above, the control unit 10 realizes the reception status detection means, the travel distance obtaining means, and the travel distance obtaining means.

As described above, the control unit 10 is provided with 2D or 3D position data from the GPS receiver 14. According to the position data provided from the GPS receiver 14, the control unit 10 detects the presence/absence of receiving position information. When position data can be detected, the position information is received. When position data cannot be detected, it is determined that position information cannot be received. When position data is not supplied by the GPS receiver 14, the control unit 10 computes the travel distance of the vehicle. In the present embodiment, the computation of the travel distance is performed based on the vehicle speed pulse signal and the diameter of the tires of the vehicle input from the vehicle speed pulse input unit 18. The control unit 10 computes the travel distance (as the duration) from the time when no position information is provided by the GPS receiver 14 to the time when position information can be provided again by the GPS receiver 14. That is, the control unit 10 computes the travel distance in which position information is not received. The control

unit 10 determines abnormal reception due to faulty equipment when the obtained travel distance exceeds a predetermined distance.

When the GPS device cannot receive radio waves from a GPS satellite, there can be reception disability due to a geographic condition or abnormal reception due to faulty equipment as described above. When the problem is reception disability due to a geographic condition, position information can be received when the vehicle exits a reception disability area such as a tunnel, etc. Therefore, while the vehicle is traveling in a reception disability area, the abnormal reception due to faulty equipment cannot be determined. Therefore, a warning of abnormal reception is to be suppressed. According to the present embodiment, when a computed travel distance exceeds a predetermined distance, the abnormal reception due to faulty equipment is determined. In this case, the predetermined distance can be set in advance. It can be set based on the country, or the area the vehicle mainly travels around. For example, when a vehicle travels downtown, 1, 2, or 3 km is set as a predetermined distance required to exit a tall building area. A predetermined distance can also be set based on an average length of tunnels. Thus, abnormal reception can be discriminated from reception disability when a warning of abnormal reception is given to a person in the vehicle. Furthermore, a predetermined distance can also be set based on the longest reception disability area, for example, the longest tunnel. For example, in the U.S.A., a predetermined distance can be set as 10 miles including a margin added to the basic length of 7.2 miles which is the length of the longest tunnel in the country. Thus, abnormal reception can be correctly discriminated from reception disability when a warning of abnormal

reception is given to a person in the vehicle. The predetermined distance can be stored in the ROM of the control unit 10.

When the control unit 10 determines abnormal reception due to faulty equipment, it turns on the orange indicator 32b. Thus, the person in the vehicle can be informed of the abnormal reception due to the faulty equipment. According to the warning, the person in the vehicle can check and repair the facilities to improve the status of the facilities before an emergency occurs.

If the GPS receiver 14 first provides position data for the control unit 10 after the control unit 10 determines abnormal reception, the determination of abnormality is released. Correspondingly, the warning works effectively until the release of the determination of abnormality after the determination is made. Thus, the person in the vehicle can be prevented from failing to recognize the warning.

Described below is the operation of the emergency information apparatus 1 according to the present embodiment. FIG. 3 is a flowchart of the operation of the emergency information apparatus 1.

First, when an ignition key is turned to the accessory position or the ON position, the emergency information apparatus 1 is turned on, thereby starting the operation of the emergency information apparatus 1 (S10).

Next, the fault detection circuit of the GPS device detects a fault (S12). For example, when the disconnection of the GPS antenna is detected (YES in S12), the red indicator 32c is turned on (S14). If no fault is detected (NO in S12), then control is passed to step S16.

The control unit 10 detects the presence/absence of receiving position information from a GPS satellite according to the position data provided from the GPS receiver 14 (S16). When no position data is detected (NO in S16), then the control unit 10 computes the travel distance of the vehicle not receiving position information (S18). The travel distance is computed based on the vehicle speed pulse signal provided from the vehicle speed pulse input unit 18. The control unit 10 determines whether or not the travel distance has exceeded a predetermined distance (S20). When the travel distance exceeds a predetermined distance (YES in S20), the control unit 10 determines abnormal reception due to faulty equipment, and turns on the orange indicator 32b (S22). Thus, the person in the vehicle can be warned of abnormal reception due to faulty equipment.

Then, the control unit 10 continues to detect the presence/absence of receiving position information from the GPS satellite (S24). When position data is not detected (NO in S24), the control unit 10 continues turning on the orange indicator 32b back in step S22. When position information is detected (YES in S24), the control unit 10 releases the determination of abnormality, turns off the orange indicator 32b (S26), and stops the warning.

If YES in S16 and NO in S20, abnormal reception due to faulty equipment cannot be determined, and control is returned to step S12 to repeat the processes.

Embodiment 2

In the above-mentioned Embodiment 1, the emergency information apparatus determines abnormal reception due to faulty equipment when position information is not received, and the travel distance exceeds a predetermined distance. According to the present embodiment, abnormal reception is determined when the traveling

time of a mobile object not receiving position information is computed, and the traveling time exceeds a predetermined time.

FIG. 4 shows the overall configuration of an emergency information apparatus 2 of a vehicle according to the present embodiment. As in the above-mentioned Embodiment 1, the same elements are assigned the same reference numerals, and repeated explanation is omitted here.

As shown in FIG. 4, the control unit 10 is connected to a timer 34 for computing the traveling time of a vehicle receiving no position information. The timer 34 measures the traveling time of a mobile object receiving no position information. That is, the control unit 10 starts the timer 34 when position data is not provided by the GPS receiver 14, and stops the timer 34 when the GPS receiver 14 provides position data. The timer 34 transmits the measured time (traveling time, duration) to the control unit 10, and the control unit 10 determines abnormal reception due to faulty equipment when the traveling time measured by the timer 34 exceeds a predetermined time.

In this case, the predetermined time can be set in advance as with the predetermined distance according to Embodiment 1, and can be set based on the country or area in which a vehicle mainly travels around, and on a limited speed or an average speed. For example, a reception disability area of large buildings of 1, 2, or 3 km long is divided by a limited speed to obtain a predetermined time. That is, the predetermined time refers to a reference time in which the vehicle can exit the reception disability area. For example, assuming that a vehicle normally travels a reception disability area of 3 km long at an average speed of 40 km/h, the predetermined time can be set to 5 min. including a margin. The predetermined

time can also be set based on the longest reception disability time, for example, based on the longest reception disability area and a limited speed or an average speed. For example, in the U.S.A., when a vehicle travels through the longest tunnel of 10 miles
5 (including a margin) at an average speed of 60 km/h, the predetermined time can be set to 15 min. Thus, abnormal reception can be correctly discriminated from reception disability when a warning of abnormal reception is given to a person in the vehicle.

Simply described below is the operation of the emergency
10 information apparatus 2 according to the present embodiment. FIG. 5 is a flowchart of the operation of the emergency information apparatus 2. In this case, the same step as in FIG. 3 is assigned the same step number, and repeated explanation is omitted here.

The differences from the flowchart according to the first
15 embodiment shown in FIG. 3 are the processes in S18 and S20. That is, when position data is not detected (NO in S16), the timer 34 measures the traveling time of the vehicle receiving no position information (S30). The traveling time measured by the timer 34 is provided for the control unit 10, and the control unit 10 determines
20 whether or not the traveling time has exceeded a predetermined time (S32). When the traveling time exceeds the predetermined time (YES in S32), the control unit 10 determines abnormal reception due to faulty equipment, and turns on the orange indicator 32b (S22). Thus, the person in the vehicle can be warned of the abnormal reception
25 due to the faulty equipment.

Embodiment 3

In the above-mentioned Embodiment 2, the traveling time of a mobile object not receiving position information is computed, and abnormal reception is determined when the traveling time exceeds

a predetermined time. However, in the emergency information apparatus 2 of the vehicle according to Embodiment 2, there is a possibility that the time in which a vehicle stops during the traveling time will be improperly measured as a traveling time. For example, when a vehicle repeats a stop state due to traffic congestion, it is possible that a determination of abnormality will be incorrectly made. The feature of the present embodiment is to accumulate the traveling time of a vehicle in which the vehicle is actually traveling so that abnormal reception can be correctly determined.

FIG. 6 shows the overall configuration of an emergency information apparatus 3 of a vehicle according to the present embodiment. The elements also shown in FIGS. 1 and 4, or corresponding elements are assigned the same reference numerals, and repeated explanation is omitted here. As shown in FIG. 6, the control unit 10 is connected to the vehicle speed pulse input unit 18 as in Embodiment 1. The vehicle speed pulse input unit 18 provides the control unit 10 with a vehicle speed pulse signal generated with the turn of the wheels of a vehicle. Thus, the control unit 10 can detect the vehicle speed. When the vehicle speed is detected (vehicle speed > 0km/h), the control unit 10 instructs the timer 34 to measure the time of the mobile object. That is, the time refers to the value obtained when the position information is not received and the vehicle speed is detected, that is, refers to the real traveling time (traveling time as a duration) of the vehicle. In detail, when the control unit 10 is provided with a vehicle speed pulse signal, the control unit 10 operates the timer 34 to measure the real traveling time. The timer 34 provides the measured real traveling time for the control unit 10. If the real traveling time exceeds a predetermined time, the control unit 10 determines abnormal

reception due to faulty equipment. The predetermined time can be set in advance as in Embodiment 2.

5 The operation of the emergency information apparatus 3 according to the present embodiment is described below. FIG. 7 is a flowchart of the operation of the emergency information apparatus 3. In this case, the steps also shown in FIG. 3 are assigned the same reference numerals, and repeated explanation is omitted here.

10 When position data is not detected (NO in S16), the control unit 10 determines whether or not the vehicle speed is detected (S40). If the vehicle speed is detected as greater than 0km/h (YES in S40), then the timer 34 measures the time, that is, the real traveling time (S42). The real traveling time measured by the timer 34 is provided for the control unit 10. If the real traveling time exceeds a predetermined time (YES in S44), then the control
15 unit 10 determines abnormal reception due to faulty equipment, and turns on the orange indicator 32b (S22). Thus, the person in the vehicle can be warned of the abnormal reception due to the faulty equipment.

Other Embodiments

20 The position detecting apparatus has been described above using an emergency information apparatus of a vehicle. However, the mobile object position detecting apparatus according to the present invention can also be applied to a navigation system for a route guide to a destination by detecting the current position of a vehicle,
25 and a mobile phone having the function of detecting its position.

Furthermore, a vehicle has been described above as a mobile object, but it can be a plane, a boat, a bike, a person, etc. According to the present invention, when a travel distance or a traveling time exceeds a predetermined value as a determination condition,

it is determined to be abnormal reception due to faulty equipment.
Therefore, the predetermined distance and the predetermined time
can be set based on type of mobile object and the geographic conditions
such as the sky, the sea, and other obstacles in the geographic
5 conditions under which the mobile object travels.

In the present embodiment, the position is detected by the GPS
device, but the present invention can be applied to any device for
detecting the position of a mobile object according to the position
information transmitted from an external position information
10 transmission apparatus.

The present invention may be embodied in other specific forms
without departing from its essential characteristics. The
described embodiment is to be considered in all respects only as
illustrative and not as restrictive. The scope of the invention
15 is, therefore, indicated by the appended claims rather than by the
foregoing description. All changes which come within the meaning
and range of the equivalence of the claims are to be embraced within
their scope.

According to the present invention, a person in the vehicle
20 can be warned of abnormal reception due to faulty equipment.
Therefore, a reception disability status can be improved.